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⑭考案の名称 光送受信モジュール

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明細書

1. 考案の名称 光送受信モジュール

2. 実用新案登録請求の範囲

側方の一端が開口した筒状のコネクタ挿入部と、上方が開口した器状の送受信器収容部とを一体に形成したケースと、前記ケースの送受信器収容部に収容された光送信器および光受信器と、前記送受信器収容部の上方を封止するカバー部材とを少なくとも備える光送受信モジュールにおいて、

前記ケースが前記送受信器収容部の内部と外部とを連通する通気孔を備え、前記通気孔の外部側が、前記ケースの上方から水を吹きつけて水洗浄する際に洗浄水が掛からない部位に開口していることを特徴とする光送受信モジュール。

3. 考案の詳細な説明

産業上の利用分野

本考案は、光送受信モジュールに関する。より詳細には、本考案は、ひとつのケースの中に光送

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信器および光受信器を収容して封止した光送受信モジュールの新規な構成に関する。

従来の技術

光通信で使用される光送受信モジュールは、発光素子および受光素子とこれらの素子に必須に接続される電子回路とをひとつのケースに収容して構成されている。また、このケースの一端には、内蔵した発光素子および受光素子と、端部をコネクタに保持された光ファイバとを相互に結合できるように、コネクタを位置決めできるような形状のコネクタ挿入部を備えている。

上述のような光送受信モジュールで使用されるケースは、通常の通信装置等と同じような金属または樹脂製の筐体を使用する場合と、溶接等により部材を気密に接合して作製した金属ケースを使用する場合とがある。また、この他に、I C等のように構成部材を樹脂で一体にモールドする方法も提案されている。

しかしながら、気密な金属ケースや樹脂モール

ドは、設計上の制約が大きい上に生産技術的にも高度なものが要求される。従って、コスト面でも不利となり、実際にこれらの構造が採用される場合は少ない。

考案が解決しようとする課題

一方、上述のような光送受信モジュールを基板上に実装する場合、ハンダ付け等により光送受信モジュールを基板上に固定した後に、水による全體の洗浄を実施することを要求される場合が近年増加している。

このような場合、前述の気密な金属ケースや樹脂モールドを使用した光送受信モジュールは、基板と共に水洗浄しても全く問題がない。しかしながら、廉価な筐体を使用した光送受信モジュールでは、洗浄時にケース内に水が侵入する場合が多く、基板への実装作業上の問題となっている。

そこで、本考案は、上記従来技術の問題点を解決し、実装時に水洗浄することが可能であり、且つ、廉価に製造することができる新規な構成の光

送受信モジュールを提供することをその目的としている。

課題を解決するための手段

即ち、本考案に従うと、側方の一端が開口した筒状のコネクタ挿入部と、上方が開口した器状の送受信器収容部とを一体に形成したケースと、前記ケースの送受信器収容部に収容された光送信器および光受信器と、前記送受信器収容部の上方を封止するカバー部材とを少なくとも備える光送受信モジュールにおいて、前記ケースが前記送受信器収容部の内部と外部とを連通する通気孔を備え、前記通気孔の外部側が、前記ケースの上方から水を吹きつけて水洗浄する際に洗浄水が掛からない部位に開口していることを特徴とする光送受信モジュールが提供される。

作用

本考案に係る光送受信モジュールは、金属または樹脂により形成された筐体に構成部材を収容し



て構成された光送受信モジュールであって、構成部材を収容した筐体の内部と外部とを連通する通気孔を具備していることをその主要な特徴としている。

具体的に後述するように、金属製または樹脂製の筐体を使用した従来の光送受信モジュールにおいても、ケースの接合部はエポキシ樹脂等により封止されており、洗浄時に内部に水が侵入することはないと考えられていた。しかしながら、実際には内部に水が侵入するので、その原因を検討した結果、以下のようなことが判明した。

即ち、ハンダ付けによる光送受信モジュールの実装工程では、ハンダによって光送受信モジュールのケースが加熱される。その直後に水洗浄が実施されると、洗浄水によってケースは冷却される。このような一連の工程に際して、加熱時にはケース内部の空気が膨張し、冷却時には収縮する。従って、内部の空気が収縮する際に洗浄水が吸引されることになり、通常ならば水が侵入しないような微細な間隙から封止されているはずのケース内

に洗浄水が侵入することが判った。

そこで、本考案に係る光送受信モジュールでは、ケースの内部と外部とを連通した通気孔を設け、ケース内部の空気が収縮する際に発生する吸引力を逃がすように構成されている。ここで、通気孔の外側の端部は、洗浄時に水がかからない部位に開口するように形成される。

以下、図面を参照して本考案をより具体的に説明するが、以下の開示は本考案の一実施例に過ぎず、本考案の技術的範囲を何ら限定するものではない。

実施例

第2図は、本考案に従って構成された光送受信モジュールの構成部材を示す図である。

同図に示すように、この光送受信モジュールは、一端が開口した筒状のコネクタ挿入部1aと、上方が開口した器状の送受信収容部1bと、両者の間の隔壁に受光窓および発光窓を備えたE.O.Eマウント1cとを一体に形成したケース1内に他の

構成部材を収容して構成されている。即ち、発光素子2および受光素子3と、これらの素子のそれぞれに接続される1対の集積回路2a、3a等がケース1の送受信器収容部1bに収められる。

通常、発光素子2および受光素子3は、ケース1のE.O.Eマウント1cに直接固定される。一方、集積回路2aおよび3aは、リードピン40a、40bを備えた1対のベース部材4a、4bにそれぞれ搭載されて送受信器収容部1bの底部に固定された上、シールド板5aおよび5b、セパレータ6等により周囲を電磁気的に遮蔽され、更に、エポキシ層7により接着／封止されたカバー部材8により物理的にも外部から遮断される。尚、多くの製品では、カバー部材8の表面には、製造者、型番、コネクタの装着方向等を記載した銘板9が貼られている。

第1図は、上述のような各要素をケースに収容あるいは装着して完成した光送受信モジュールの構造を示す断面図である。

同図に示すように、この光送受信モジュールで

は、ケース1においてコネクタ挿入部1aと送受信収容部1bとを仕切っているEOEマウント1cに、コネクタ挿入部1a側と送受信収容部1b側とを連通するように通気孔10が設けられている。

一方、ケース1の送受信器収容部1bの底部には、集積回路3aを搭載したベース部材4bが収容されており、ベース部材4bのリードピン40bが送受信器収容部1bの底部に形成された孔を貫通してケース1の下方に突出しているが、このリードピン40bを挿通された送受信器収容部1bの孔はエポキシ層7aによって気密に封止されている。

また、発光素子2はEOEマウント1cに、集積回路3bはベース部材4a上にそれぞれ固定されており、発光層3の後方から集積回路3aまでの領域は、シールド板5bにより覆われている。これらの部材を収容した送受信器収容部1bの上側開口部は、エポキシ層7により気密に接着されたカバー部材8により封止されている。

以上のように構成された光送受信モジュールは、

送信用および受信用の1対の光ファイバを保持したコネクタをケース1のコネクタ挿入部1aに挿入することにより、受光素子2および発光素子3とそれぞれの光ファイバとを結合させることができる。また、この光送受信モジュールでは、実装工程および水洗浄工程において膨張または収縮する送受信器収容部1b内部の空気は、通気孔10を介して出入りするので、エポキシ層7または7aの微細な隙間から洗浄水が吸引されることがない。

本考案の効果を確認するために、通気孔10が無いことを除いては、第1図に示したものと全く同じ構成の光送受信モジュールを作製し、加熱と水洗浄とを連続して行った。

まず、ケース全体を150℃に加熱した後、ケース1の上方から洗浄水をかけた。ケースの温度が室温程度まで低下してから、カバー部材8を除去して送受信器収容部1bの中を検査したところ、内部に水滴があった。これは、カバー部材を封止しているエポキシ層か、リードピンの貫通孔を封止しているエポキシ層に僅かな間隙が発生してい

たためと考えられる。

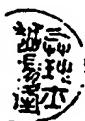
続いて、送受信器収容部1b内の水滴を除去してから、第1図に示したような通気孔10を形成し、送受信器収容部1bをカバー部材によって封止した後に、改めて加熱および水洗浄を実施した。ケース1の冷却後に、再びカバー部材8を取り除いて検査したところ、送受信器収容部1b内には全く洗浄水は侵入していなかった。

考案の効果

以上説明したように、本考案による光送受信モジュールは、ハンダ付けによる実装工程の直後に水洗浄を実施しても、洗浄水が内部に侵入することがない。

即ち、本考案に従う光送受信モジュールは、廉価に製造することができる構造でありながら、実装後に水洗浄を行うことができる好ましい光送受信モジュールである。

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4. 図面の簡単な説明

第1図は、本考案に従って構成された光送受信モジュールの具体的な構成例を示す断面図であり、

第2図は、第1図に示した光送受信モジュールの構成部材とその組立てを説明するための図である。

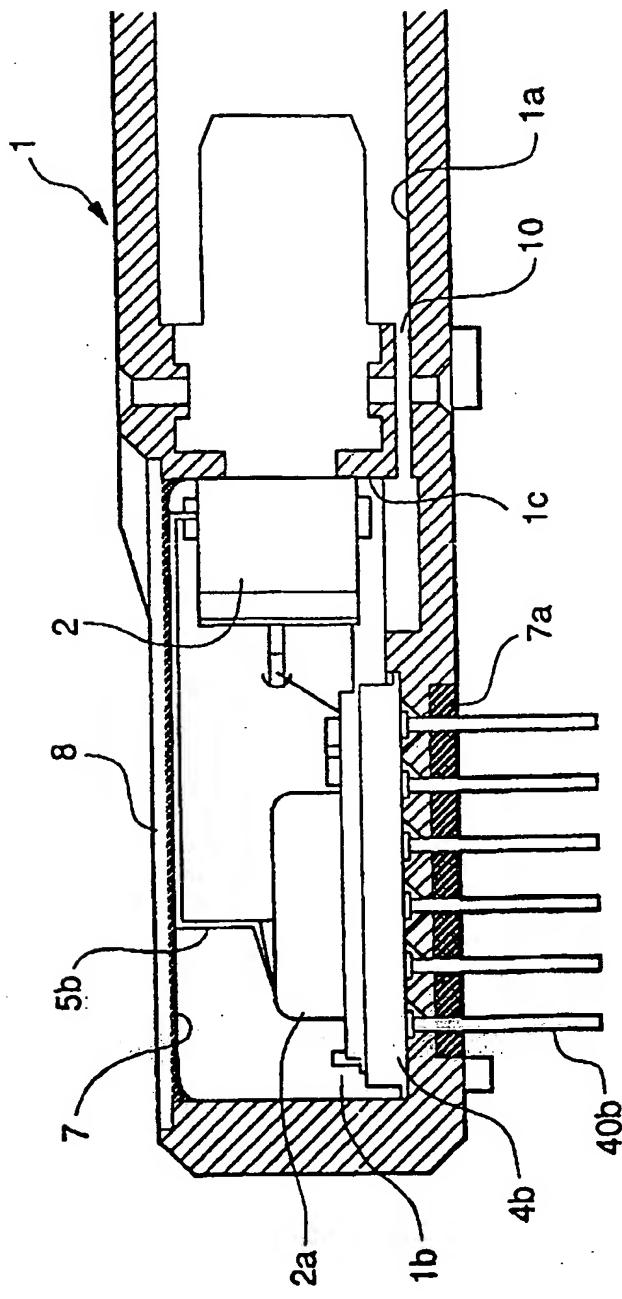
〔主な参照番号〕

- 1 . . . ケース、 2 . . . 発光素子、
- 3 . . . 受光素子、
- 4 a、4 b . . . ベース部材、
- 5 a、5 b . . . シールド板、
- 6 . . . セパレータ、
- 7、7 a . . . エポキシ層、
- 8 . . . カバー部材、9 . . . 銘板、
- 10 . . . 通気孔

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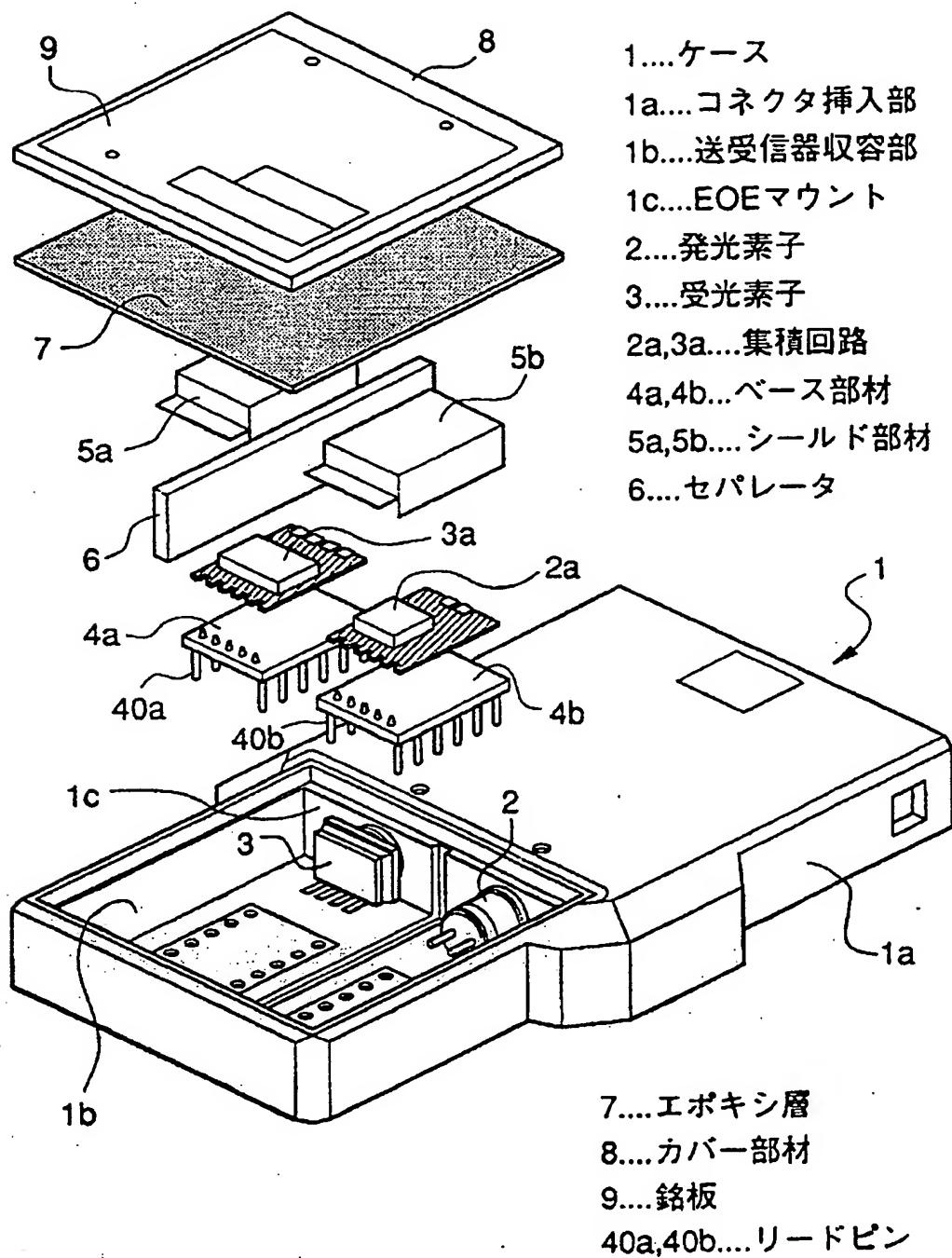
第1図



1...ケース 1c...EOEマウント 2...発光素子 2a...集積回路
4b...ベース部材 5b...シールド部材 7,7a...エポキシ層 8...カバーパー部材 10...貫通穴

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第2図



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(54) Title of the Invention

OPTICAL TRANSMITTER AND RECEIVER MODULE

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Specification

1. Title of the Invention

OPTICAL TRANSMITTER AND RECEIVER MODULE

2. Claim

In an optical transmitter and receiver module comprising at least a case integrally formed with a cylindrical connector insertion part one end of whose side is opened and a transmitter and receiver reception part in a shape of a vessel whose upper portion is opened, an optical transmitter and an optical receiver which are accommodated in the transmitter and receiver reception part of the case, and a covering member which seals an upper portion of the transmitter and receiver reception part,

an optical transmitter and receiver module characterized in that the case has an air hole which interconnects inside and outside of the transmitter and receiver reception part, and an external side of the air hole is opened at such a position that cleaning water is not applied on the occasion that water cleaning is carried out by spraying water from the upper portion of the case.

3. Detailed Description of the Invention

Industrial Field of Application

This invention relates to an optical transmitter and receiver module. In more detail, this invention relates to

a novel structure of an optical transmitter and receiver module in which an optical transmitter and an optical receiver are accommodated and sealed in one case.

Prior Art

An optical transmitter and receiver module which is used in an optical communication is configured such that a light emitting device and a photo acceptance device and an electronic circuit indispensably connected to these devices are accommodated in one case. Also, at one end of this case, provided is a connector insertion part with such a shape of being able to locate a connector, so that the built-in light emitting device and photo acceptance device and an optical fiber whose end part was held by the connector can be connected one another.

As a case to be used in the optical transmitter and receiver module as described above, there are instances that a housing made by a metal or resin similar to those used in a normal communication apparatus etc. is used and that a metal case formed by bonding members air tightly by means of welding etc. is used. Also, besides this, like IC etc., a method in which component members are integrally molded by resin has been proposed.

However, the air tight metal case and resin mold have big design limitation and further, require an advanced manufacturing technique. Accordingly, there is a deficit in cost and there are few cases that these structures are adopted

in fact.

Problem that the Invention is to Solve

On the other hand, in case that the optical transmitter and receiver module as described above is mounted on a substrate, there has recently increased a case that overall cleaning by water is required to be carried out, after the optical transmitter and receiver module was fixed to the substrate by soldering etc.

In such a case, the optical transmitter and receiver module which used the above-described air tight metal case and resin mold has no problem at all even if it is water-cleaned together with the substrate. However, in an optical transmitter and receiver module which used an inexpensive housing, there are many cases that water intrudes into a case on the occasion of cleaning, which has become a problem on mounting works to the substrate.

Then, this invention aims to provide an optical transmitter and receiver module of a novel structure which solves the above-described problem of the prior art, can carry out water cleaning on the occasion of mounting, and can be manufactured at low cost.

Means for Solving the Problem

That is, according to this invention, in an optical

transmitter and receiver module comprising at least a case integrally formed with a cylindrical connector insertion part one end of whose side is opened and a transmitter and receiver reception part in a shape of a vessel whose upper portion is opened, an optical transmitter and an optical receiver which are accommodated in the transmitter and receiver reception part of the case, and a covering member which seals an upper portion of the transmitter and receiver reception part, provided is an optical transmitter and receiver module characterized in that the case has an air hole which interconnects inside and outside of the transmitter and receiver reception part, and an external side of the air hole is opened at such a position that cleaning water is not applied on the occasion that water cleaning is carried out by spraying water from the upper portion of the case.

Operation

The optical transmitter and receiver module according to this invention is an optical transmitter and receiver module which is configured such that component members are accommodated in a housing which was formed by metal or resin, and mainly characterized by having an air hole for interconnecting inside and outside of the housing for accommodating the component members.

As concretely described later, even in a conventional

optical transmitter and receiver module which used a housing made by metal or resin, it was believed that a bonding part of a case is sealed by epoxy resin etc. and water does not intrude into inside on the occasion of cleaning. However, in reality, water intrudes into inside, and as a result of studying its causes, the followings were found.

That is, in a mounting process of an optical transmitter and receiver module by soldering, a case of the optical transmitter and receiver module is heated by solder. When water cleaning is carried out right after it, the case is cooled by cleaning water. On the occasion of a set of these processes, when heated, air inside of the case is expanded, and when cooled, it is deflated. Accordingly, it was found that, on the occasion that the inside air is deflated, the cleaning water is to be sucked, and the cleaning water intrudes into the case which is to be sealed from a minute space into which water does not intrude in an ordinary circumstance.

Then, in the optical transmitter and receiver module according to this invention, it is configured such that an air hole for interconnecting inside and outside of the case is disposed, and a sucking force occurring on the occasion that air inside of the case is deflated is let out. Here, an external end part of the air hole is formed such that it is opened at such a position that water is not applied on the occasion of cleaning.

Hereinafter, this invention will be described more concretely with reference to the drawings but the following disclosure is simply one embodiment of the invention and does not give any limitation to a technical scope of the invention.

Embodiment

Fig. 2 is a view which shows component members of an optical transmitter and receiver module configured according to this invention.

As shown in the figure, this optical transmitter and receiver module is configured such that, in a case 1 integrally formed with a cylindrical connector insertion part 1a whose one end is opened, a transmitter and receiver reception part 1b in a shape of a vessel whose upper portion is opened, and an EOE mount 1c having a photo acceptance window and a light emitting window on a partition wall between both members, other component members are accommodated. That is, a light emitting device 2 and a photo acceptance device 3, and a pair of integrated circuits 2a, 3a, etc. which are connected to these devices respectively are accommodated in the transmitter and receiver reception part 1b of the case 1.

Normally, the light emitting device 2 and the photo acceptance device 3 are fixed directly to the EOE mount 1c of the case 1. On the other hand, the integrated circuits 2a and 3a are respectively mounted on a pair of base members 4a, 4b

having lead pins 40a, 40b and fixed to a bottom part of the transmitter and receiver reception part 1b, and further, a periphery thereof is electromagnetically shielded by shield plates 5a and 5b and a separator 6 etc., and further, also physically shielded from outside by a covering member 8 which was adhered and sealed by an epoxy layer 7. In addition, in many products, on a surface of the covering member 8, a name plate 9 on which a manufacturer, a model number, a mounting direction of a connector etc. were described is affixed.

Fig. 1 is a cross sectional view which shows a structure of the optical transmitter and receiver module which was completed by accommodating or mounting respective elements as described above in the case.

As shown in the figure, in this optical transmitter and receiver module, on the EOE mount 1c which comparting the connector insertion part 1a and the transmitter and receiver reception part 1b in the case 1, an air hole 10 is disposed so as to interconnect the connector insertion part 1a side and the transmitter and receiver reception part 1b side.

On the other hand, in the bottom part of the transmitter and receiver reception part 1b of the case 1, the base member 4b on which the integrated circuit 3a was mounted is accommodated, and the lead pin 40b of the base member 4b passes through a hole formed in the bottom part of the transmitter and receiver reception part 1b and protrudes below the case 1 but the hole

of the transmitter and receiver reception part 1b through which this lead pin 40b passes is air tightly sealed by the epoxy layer 7a.

Also, the light emitting device 2 and the integrated circuit 3b are fixed to the EOE mount 1c and the base member 4a, respectively, and an area from a backside of a light emitting layer 3 to the integrated circuit 3a is covered by a shield plate 5b. An upper side opening part of the transmitter and receiver reception part 1b which accommodates these members is sealed by the covering member 8 which was adhered air tightly by the epoxy layer 7.

In the optical transmitter and receiver module configured as above, by inserting a connector which held a pair of optical fibers for transmission and for reception in the connector insertion part 1a of the case 1, the photo acceptance device 2 and the light emitting device 3 and the respective optical fibers can be bonded. Also, in this optical transmitter and receiver module, air inside of the transmitter and receiver reception part 1b which is expanded or deflated in a mounting process and a water cleaning process moves in and out through the air hole 10, and therefore, there is no case that cleaning water is sucked from a minute space of the epoxy later 7 or 7a.

In order to confirm an advantage of this invention, prepared was an optical transmitter and receiver module which

is completely the same structure as shown in Fig. 1, except for absence of the air hole 10, and heating and water cleaning were carried out successively.

Firstly, after the entire case is heated at 150°C, the cleaning water was applied from above of the case 1. Temperature of the case went down to room temperature and then, the covering member 8 was removed and inside of the transmitter and receiver reception part 1b was inspected, and as a result, there was water droplets therein. It is contemplated that this is because a subtle space occurred in the epoxy layer which is sealing the covering member or in the epoxy layer which is sealing a through-hole of the lead pin.

Subsequently, the water droplets in the transmitter and receiver reception part 1b were removed and then, the air hole 10 as shown in Fig. 1 was formed, and the transmitter and receiver reception part 1b was sealed by the covering member and thereafter, heating and water cleaning were again carried out. After the case 1 was cooled, the covering member 8 was again removed and inspected, and as a result, the cleaning water did not intrude into the transmitter and receiver reception part 1b at all.

Advantage of the Invention

As described above, in an optical transmitter and receiver module according to this invention, even if water cleaning is

carried out right after a mounting process by soldering, cleaning water does not intrude into inside.

That is, the optical transmitter and receiver module according to this invention is of not only a structure which can be manufactured at low cost but also a desirable optical transmitter and receiver module in which water cleaning can be carried out after mounting.

4. Brief Description of the Drawings

Fig. 1 is a cross sectional view which shows a concrete structural example of an optical transmitter and receiver module which was configured according to this invention, and

Fig. 2 is a view for explaining component members of the optical transmitter and receiver module shown in Fig. 1 and its assembly.

[Major Reference Numerals]

- 1...case, 2...light emitting device,
- 3...photo acceptance device,
- 4a, 4b...base member
- 5a, 5b...shield plate,
- 6...separator,
- 7, 7a...epoxy layer,
- 8...covering member, 9...name plate,
- 10...air hole

Utility Model Registration Applicant

Sumitomo Electric Industries, Ltd.

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Fig. 1

1...CASE
1c...EOE MOUNT
2...LIGHT EMITTING DEVICE
2a...INTEGRATED CIRCUIT
4a...BASE MEMBER
5...SHIELD MEMBER
7,7a...EPOXY LAYER
8...COVERING MEMBER
10...THROUGH-HOLE

Fig. 2

1...CASE
1a...CONNECTOR INSERTION PART
1b...TRANSMITTER AND RECEIVER RECEPTION PART
1c...EOE MOUNT
2...LIGHT EMITTING DEVICE
3...PHOTO ACCEPTANCE DEVICE
2a,3a...INTEGRATED CIRCUIT
4a,4b...BASE MEMBER
5a,5b...SHIELD MEMBER
6...SEPARATOR
7...EPOXY LAYER
8...COVERING MEMBER
9...NAME PLATE
40a,40b...LEAD PIN

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